Table H-2. Strength of evidence for Key Question 2: aerobic exercise for cerebral palsy

| **Intervention**  **Category,**  **Intervention** | **Comparator** | **Outcome** | **Number of Studies (Participants)**  **Author Year**  **(See Appendix B for Full Citation)** | **Study Limitations** | **Consistency** | **Precision** | **Reporting Bias** | **Strength of Evidence** | **Findings, Direction and Magnitude of Effect** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Aerobic Exercise**  Aerobics | *Usual care, previous activity level or attention control* | ADLs | 1 (26)  Teixeira-Machado, 2018 | Moderate | Unknown | Imprecise | Undetected | Insufficient | ICF total change score:  -44.56 vs. 14.90, p<0.001 |
| **Aerobic Exercise**  Aerobics | *Usual care* | Running/ mobility | 1 (42)  Gibson, 2018 | Low | Unknown | Imprecise | Undetected | Insufficient | Shuttle Run Test (min): 0.9, 95% CI -0.3 to 2.2, p=0.142  HiMat: 0.8, 95% CI -2.7 to 4.3, p=0.651  10X5 sprint (sec): -1.3, 95% CI -5.4 to 2.8, p=0.535 |
| **Aerobic Exercise**  Aquatics | *Land-based exercise* | Function | (N=32)  Adar, 2017 | Moderate | Unknown | Imprecise | Undetected | Insufficient | Mean SD:  TUG: -0.13 (0.14) vs. -0.16 (0.13), p=0.664 GMGM-88: 0.05 (0.05) vs. 0.05 (0.03), p=0.451 WeeFIM motor: 0.04 (0.04) vs. 0.06 (0.06),p=0.860  WeeFIM total: -0.13 (0.14) vs. -0.16 (0.13), p=0.287  N=24, Mean (SD) |
| **Aerobic Exercise**  Aquatics | *Rehabilitation exercises* | Function | 1 (24)  Lai, 2015 | Moderate | Unknown | Imprecise | Undetected | Insufficient | GMFM-66: 61.2 (18.7) vs. 64.6 (19.4) (baseline) 66.2 (18.2) vs. 65.3 (19.1) (postintervention) Difference in change score between groups:p=0.007 |
| **Aerobic Exercise**  Aquatics | *Rehabilitation exercises* | Quality of Life | 1 (24)  Lai, 2015 | Moderate | Unknown | Imprecise | Undetected | Insufficient | Cerebral Palsy QoL Scale: for Social, Functioning, Participation, Emotional, Access, Pain and Disability, and Family Health: All NS |
| **Aerobic Exercise**  Aquatics | *Rehabilitation exercises* | ADLs | 1 (24)  Lai, 2015 | Moderate | Unknown | Imprecise | Undetected | Insufficient | Vineline Adaptive Behavior Scale for Daily Living: 72.1 (48.5) vs. 93.7 (43.8) (baseline) 76.5 (7.6) vs. 76.4 (10.8) (post-intervention)  Difference in change score between groups: p=0.393 |
| **Aerobic Exercise**  Cycling | *Usual care, previous activity level or attention control* | Function | 2 (85)  Fowler 2010  Bryant 2013 | Moderate | Consistent | Imprecise | Undetected | Low for benefit | GMFM-66 pooled: 0.70, 95% CI -0.20 to 1.60, p=0.127  GMFM-88D: 5.4, 95% CI 1.23 to 9.57, p=0.01  GMFM-88E: 2.3, 95% CI 0.20 to 4.40, p=0.03  600-Yard Walk-Run Test: Change from baseline: 5.6, 95% CI 1.6 to 9.5 vs. 2.5, 95% CI -1.1 to 6.0, p=0.24 |
| **Aerobic Exercise**  Cycling | *Usual care, previous activity level or attention control* | Quality of Life | 1 (62)  Demuth, 2012 | Moderate | Unknown | Imprecise | Undetected | Insufficient | Peds Quality of Life Total Score: 3.5, 95% CI -2.0 to 8.8, p=0.21 |
| **Aerobic Exercise**  Robot- Assisted Gait Training | *Usual care, previous activity level or attention control* | Function | 12 RCTs (77); 1 cohort study (24)  Wallard, 2017  Wallard, 2018  Klobucka, 2020  Yazici, 2019 | High | Consistent | Imprecise | Undetected | Insufficient | GMFM-66D: 4.73, 95% CI -6.14 to 15.60, p=0.39  GMFM-66E: 7.54, 95% CI -2.64 to 17.42, p=0.15  GMFM-88: 1.59, 95% CI -2.19 to 5.37, p=0.410  GMFM-88D: 0.17, 95% CI -0.79 to 1.13, p=0.729  GMFM-88E: 1.14, 95% CI -1.69 to 4.51, p=0.373  6MWT: 43.42, 95% CI 19.64 to 67.21, p<0.001  GMFM-88: MD 9.43, 95% CI 6.989 to 11.891 vs. MD 0.80, 95% CI 0.154 to 1.446, p<0.001  GMFM-88D: MD 8.30, 95% CI 4.699 to 11.901 vs. MD 1.09, 95% CI -0.438 to 2.619, p<0.001  GMFM-88E: MD 9.32, 95% CI 5.329 to 13.310 vs. MD 0.53, 95% CI -0.208 to 1.268, p<0.001 |
| **Aerobic Exercise**  Robot-Assisted Gait Training | *Usual care, previous activity level or attention control* | Balance | 1 (24)  Yazici, 2019 | High | Unknown | Imprecise | Undetected | Insufficient | BBS: 1.25, 95% CI -0.07 to 2.57, p=0.064 |
| **Aerobic Exercise**  Robot-Assisted Gait Training | *Treadmill training (Partial body-weight supported; Anti-gravity;)* | Function | 2 (52)  Aras, 2019  Wu, 2017b | Moderate | Consistent | Imprecise | Undetected | Insufficient | 6MWT: 39.6 (40.4) vs. 37.6 (20.2) vs. 48.3 (25.1), p>0.05 for all pairwise comparisons  6MWT (3 mo followup): 45.2 (44.4) vs. 48.6 (37.8) vs. 58.2 (22.9), p>0.05 for all pairwise comparisons  GMFM-D: 3.6 (2.5) vs. 4.6 (4.6) vs. 3.5 (2.5), p>0.05 for all pairwise comparisons  GMFM-D (3 mo followup): 3.6 (2.5) vs. 4.6 (4.6) vs. 3.5 (2.5), p>0.05 for all pairwise comparisons  GMFM-E: 2.4 (2.0) vs. 2.6 (1.7) vs. 3.7 (1.9), p>0.05 for all pairwise comparisons  GMFM-E (3 mo followup): 2.6 (1.8) vs. 2.6 (1.7) vs. 3.7 (1.9), p>0.05 for all pairwise comparisons  GMFM-66 total: –5.1, 95% CI 13.62 to 3.42, p=0.24  GMFM-66-D: 3.6, 95% CI –5.40 to 12.60, p=0.43  GMFM-66-E: 0.2, 95% CI –17.79 to 19.19, p=0.98 |
| **Aerobic Exercise**  Treadmill | *Usual care, previous activity level or attention control* | Function | 2 (53)  Chrysagis, 2012  Bahrami, 2019a | Moderate | Consistent | Imprecise | Undetected | Low for benefit | GMFM-D+E: 3.87 vs. 0.69, p=0.007  Self-selected walking speed: 8.06 vs. 0.48, p=0.009  10MWT: 1.080 (0.47) to 1.22 (0.50) [22.46% change] vs. 0.99 (0.56) to 1.02 (0.61) [1.28% change], % change p<0.05  6MWT: 291.13 (160.28) to 342.63 (174.62) [23.68% change] vs. 276.10 (167.19) to 308.57 (181.22)[16.54% change], % change p>0.05 |
| **Aerobic Exercise**  Treadmill | *Usual care* | Quality of Life | 1 (30)  Bahrami, 2019a | Moderate | Unknown | Imprecise | Undetected | Insufficient | WHOQOL-Brief: 3.55 (.55) to 3.66 (0.59) [3.83% change] vs. 3.33 (0.69) 3.57 (0.67)[8.94% change], % change p>0.05 |
| **Aerobic Exercise**  Treadmill | *Overground walking* | Walking | 5 (130)  Willoughby, 2010  Swe, 2015  Grecco, 2013  Emara, 2016  Kim, 2015 | Moderate | Inconsistent | Imprecise | Undetected | Low strength of evidence for no clear benefit | 10MWT: 0.4 (0.04) to 0.5 (0.04) vs. 0.4 (0.03) to 0.6 (0.04), p=0.12  6MWT: 149.7 vs. 44.8, p<0.001  6MWT: -17.00, 95% CI -89.77 to 55.77, p=0.65  10MWT: -0.013, 95% CI -0.23, 0.21, p=0.91  10MWT: 244.33 (115.41) to 219.38 (123.71) vs. 118.36 (89.89) to 135.82 (95.65), p=0.097  6MWT on treadmill: 5.71, 95% CI -53.22 to 64.64, p=0.85  6MWT on overground walking: 24.07, 95% CI -46.80 to 94.94, p=0.51 |
| **Aerobic Exercise**  Treadmill | *Overground walking* | Function | 4 (109)  Willoughby, 2010  Swe, 2015  Grecco, 2013  Emara, 2016 | Moderate | Inconsistent | Imprecise | Undetected | Low strength of evidence for no clear benefit | 5XSit-to-Stand: 21.5 (1.3) to 18.9 (1.0) vs. 21.7 (1.5) to 17.7 (0.8), p=0.26  GMFM-88 D: 12.5 (1.6) to 15.8 (1.5) vs.12.0 (0.7) to 19.2 (2.1), p=0.02, favors spider cage  GMFM-88 E: 10.9 (1.3) to 14.8 (1.5) vs.10.4 (0.8) to 17.2 (2.1), p=0.05, favors spider cage  TUG: -6.4 vs. -2.0, p=0.004, favors treadmill  GMFM-88D: 23.9 vs. 8.1, p<0.001, favors treadmill  GMFM-88E: 20.1 vs. 8.2, p<0.001, favors treadmill  GMFM-88D: -2.94, 95% CI -16.42 to 10.64, p=0.67  GMFM-88E: -2.8, 95% CI -20.02 to 14.42, p=0.75 |
| **Aerobic Exercise**  Treadmill | *Treadmill training with TDC stim vs. Treadmill training with sham TDC* | Function | 1 (24)  Grecco, 2014 | Moderate | Unknown | Imprecise | Undetected | Insufficient | 6MWT: 102.4, 95% CI 33.16 to 171.64, p=0.004  GMFM-88D: 7.8, 95% CI 0.46 to 15.15, p=0.037  GMFM-88E: -3.39 to 12.99, p=0.251 |
| **Aerobic Exercise**  Treadmill | *Treadmill training with TDC stim vs. Treadmill training with sham TDC* | Balance | 1 (24)  Duarte Nde, 2014 | Moderate | Unknown | Imprecise | Undetected | Insufficient | PBS: 40.5 (9.4) to 45.3 (7.9) vs.39.1 (9.8) to 39.7 (8.4); MD 4.2, 95% CI -2.88 to 11.28, p=0.245 |
| **Aerobic Exercise**  Treadmill | *Treadmill training with TDC stim vs. Treadmill training with sham TDC* | ADLs | 1 (24)  Duarte Nde, 2014 | Moderate | Unknown | Imprecise | Undetected | Insufficient | PEDI self-care: 46.1 (10) to 48.0 (9.5) vs. 45.0 (9.2) to 45.5 (9.3); MD 1.4, 95% CI -6.21 to 9.01, p=0.718  PEDI mobility: 38.0 (8.5) to 41.7 (7.4) vs. 38.3 (7.4) to 39.5 (7.6); MD 2.5, 95% CI -3.71 to 8.71, p=0.430 |
| **Aerobic Exercise**  Treadmill | *Individualized strength-based physical therapy* | Function | 1 (26)  Johnston, 2011 | Moderate | Unknown | Imprecise | Undetected | Insufficient | GMFM: 62.7 (17.5) to 63.3 (16.2) vs. 58.4 (26.9) to 60.1 (25.1), p=0.66 |
| **Aerobic Exercise**  Treadmill (for adults with CP) | *Strength Training or Usual care* | Function | 2 RCTs (51)  Kim, 2015  Bahrami, 2019a  1 quasiexperi-mental trial (95)  Aviram, 2017 | Moderate | Inconsistent | Imprecise | Undetected | Low-strength evidence for no clear benefit | 6MWT on treadmill: 5.71, 95% CI -53.22 to 64.64, p=0.85  6MWT on overground walking: 24.07, 95% CI -46.80 to 94.94, p=0.51  6MWT: 20.9 (4.0) vs. 27.9 (6.7), p=0.31  TUG: -2.82 (0.51) vs. 3.52 (0.60), p=0.014, favors strength training  GMFM-66: 1.98 (0.40) vs. 3.10 (0.44), p=0.001, favors strength training  GMFM-66D: 5.53 (1.61) vs. 8.36 (1.24), p=0.013, favors strength training  GMFM-66E: 4.80 (1.33) vs. 7.21 (0.96), p=0.81  10MWT-self-paced: 0.272 (0.045) vs. 0.276 (0.049), p=0.41  10MWT-fast: 0.387 (0.070) vs. 0.374 (0.069), p=0.30  10MWT: 1.080 (0.47) to 1.22 (0.50) [22.46% change] vs. 0.99 (0.56) to 1.02 (0.61) [1.28% change], % change p<0.05  6MWT: 291.13 (160.28) to 342.63 (174.62) [23.68% change] vs. 276.10 (167.19) to 308.57 (181.22)[16.54% change], % change p>0.05 |
| **Aerobic Exercise**  Treadmill (for adolescents with CP) | *Physical Therapy or Overground Walking* | Function | 2 RCTs (56)  Chrysagis, 2012  Swe, 2015  1 Quasi-experimental study (24)  Nsenga-Leunkau, 2012 | Moderate | Consistent | Imprecise | Undetected | Low-strength evidence for no clear benefit | 6MWT: -17.00, 95% CI -89.77 to 55.77, p=0.65  10MWT: -0.013, 95% CI -0.23, 0.21, p=0.91  GMFM-88D: -2.94, 95% CI -16.42 to 10.64, p=0.67  GMFM-88E: -2.8, 95% CI -20.02 to 14.42, p=0.75  10MWT: 244.33 (115.41) to 219.38 (123.71) vs. 118.36 (89.89) to 135.82 (95.65), p=0.097  6MWT: 480 to 601 vs. 450 to 450, no difference in baseline values, significant difference in post-intervention values favoring treatment |
| **Aerobic Exercise**  Treadmill (for children with CP) | *Overground walking with or without spider cage, treadmill walking with sham transcranial DC stim, Individual strength-based PT* | Function | 4 (103)  Johnston, 2011  Emara, 2016  Grecco, 2013  Grecco, 2014 | Moderate | Inconsistent | Imprecise | Undetected | Low-strength evidence for no clear benefit | 10MWT: 0.4 (0.04) to 0.5 (0.04) vs. 0.4 (0.03) to 0.6 (0.04), p=0.12  5XSit-to-Stand: 21.5 (1.3) to 18.9 (1.0) vs. 21.7 (1.5) to 17.7 (0.8), p=0.26  GMFM-88 D: 12.5 (1.6) to 15.8 (1.5) vs.12.0 (0.7) to 19.2 (2.1), p=0.02, favors spider cage  GMFM-88 E: 10.9 (1.3) to 14.8 (1.5) vs.10.4 (0.8) to 17.2 (2.1), p=0.05, favors spider cage  6MWT: 102.4, 95% CI 33.16 to 171.64, p=0.004  GMFM-88D: 7.8, 95% CI 0.46 to 15.15, p=0.037  GMFM-88E: 4.8, 95% CI -3.39 to 12.99, p=0.251  6MWT: 149.7 vs. 44.8, p<0.001  TUG: -6.4 vs. -2.0, p=0.004  GMFM-88D: 23.9 vs. 8.1, p<0.001  GMFM-88E: 20.1 vs. 8.2, p<0.001  GMFM: 62.7 (17.5) to 63.3 (16.2) vs. 58.4 (26.9) to 60.1 (25.1), p=0.66 |

Abbreviations: 6MWT = 6-Minute Walking Test; 10MWT=10-Minute Walking Test; BBS = Berg Balance Scale; CI = confidence interval;CP = cerebral palsy; HiMat = High Level Mobility Assessment Tool; GMFM = The Gross Motor Function Measure; ICF = International Classification of Functioning, Disability and Health; NA = not applicable; PBS = Pediatric Balance Scale; PEDI = Pediatric Evaluation of Disability Inventory; RCT = randomized controlled trial; TUG= Timed Up and Go Test; WHOQOL = World Health Organization Quality of Life